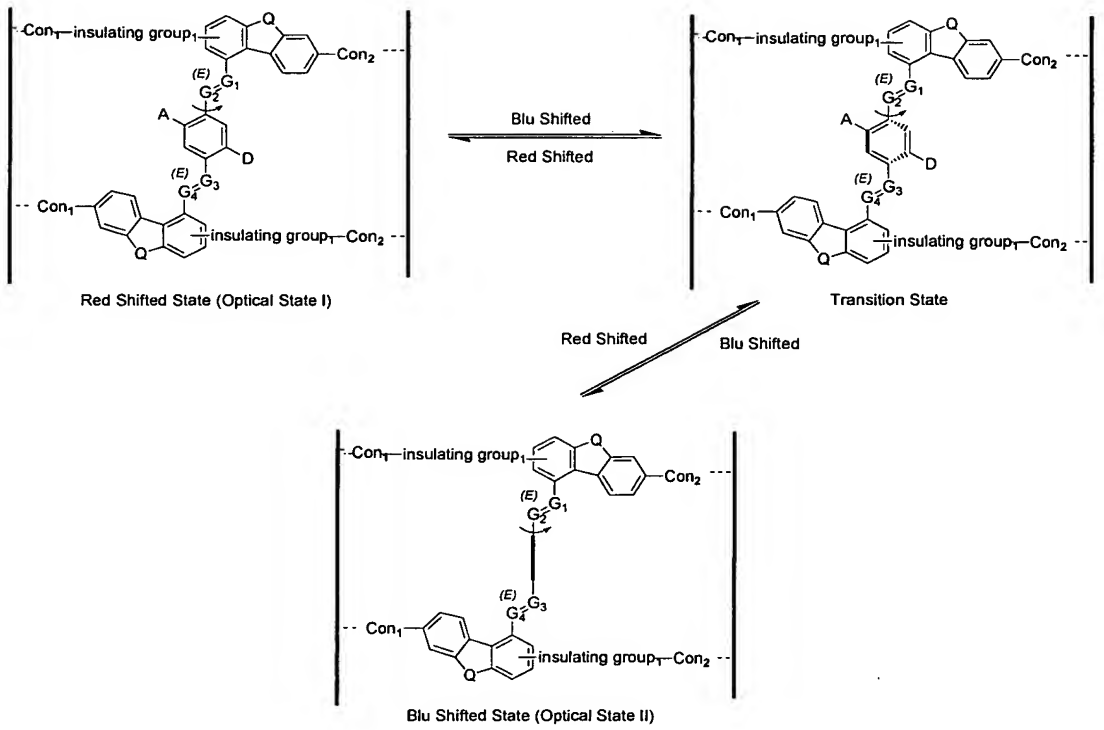
AMENDMENTS TO THE CLAIMS

The following is a listing of all claims presently in the application, wherein Claim 14 is amended as follows:

14. (currently amended) A bi-stable molecular molecular system having one rotor portion connected between two stator portions, wherein said rotor portion rotates with respect to said stator portions between at least two different states upon application of said electric field, thereby inducing a band gap change in said molecular system, wherein in a first optical state, there is substantial extended conjugation throughout said molecular system, resulting in a relatively smaller band gap, thereby forming a "red-shifted state", and wherein in a second optical state, said extended conjugation is ~~destroyed~~ changed, resulting in a relatively larger band gap, thereby forming a "blue-shifted state".

15. (original) The molecular system of Claim 14 wherein said molecular system has an orientation axis and wherein said rotor portion is oriented perpendicular to said orientation axis, with said external electric field applied parallel to said orientation axis.

16. (original) The molecular system of Claim 15 comprising:




where

A is an Acceptor group comprising an electron-withdrawing group selected from the group consisting of: (a) hydrogen, (b) carboxylic acid and its derivatives, (c) sulfuric acid and its derivatives, (d) phosphoric acid and its derivatives, (e) nitro, (f) nitrile, (g) hetero atoms selected from the group consisting of N, O, S, P, F, Cl, and Br, (h) functional group with at least one of said hetero atoms, (i) saturated or unsaturated hydrocarbons, and (j) substituted hydrocarbons;

D is a Donor group comprising an electron-donating group selected from the group consisting of: (a) hydrogen, (b) amines, (c) OH, (d) SH, (e) ethers, (f) saturated or unsaturated hydrocarbons, (h) substituted hydrocarbons, and (i) functional groups with at least one of hetero atom selected from the group consisting of B, Si, N, O, S, P, and I, wherein said Donor group is relatively more electropositive than said Acceptor group;

$Con_1$ and $Con_2$ are connecting units between one molecule and another molecule or between a molecule and a solid substrate selected from the group consisting of a metal electrode, an inorganic substrate, and an organic substrate, said connecting units independently selected from the group consisting of: (a) hydrogen

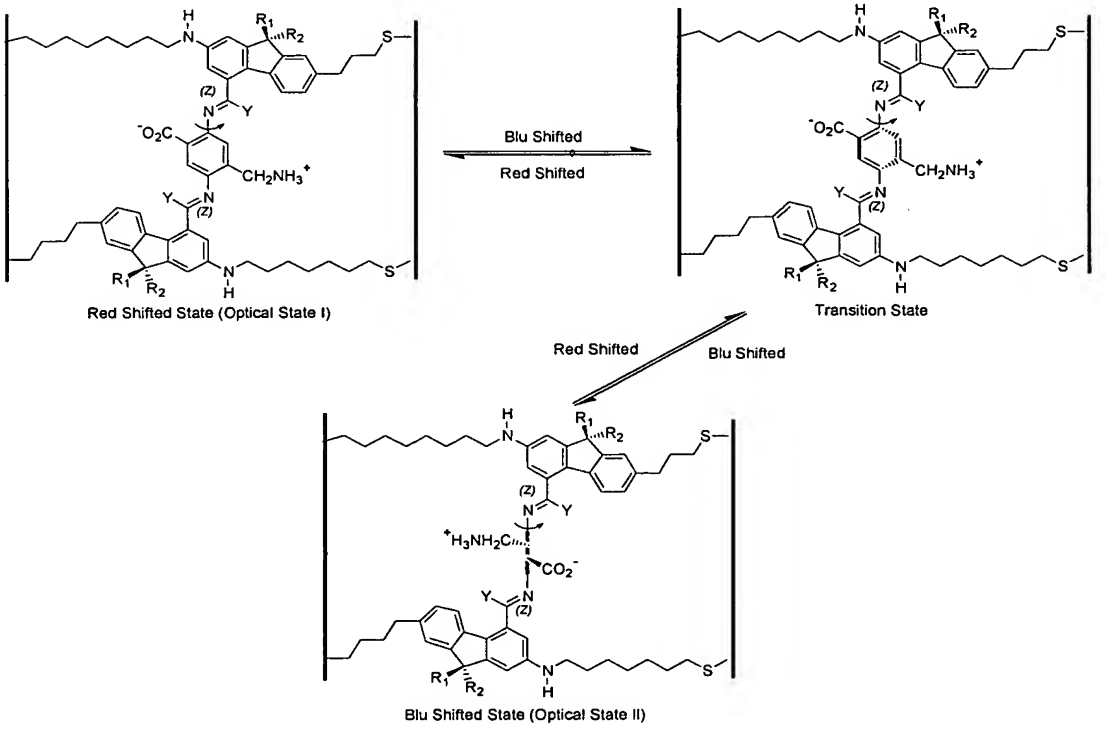
(utilizing a hydrogen bond), (b) multivalent hetero atoms selected from the group consisting of C, N, O, S, and P, (c) functional groups containing said hetero atoms, (d) saturated or unsaturated hydrocarbons, and (d) substituted hydrocarbons;

$G_1$, $G_2$, $G_3$, and $G_4$ are bridging groups for connecting said stator to each rotor or to connect two or more conjugated rings to achieve a desired electronic property, said bridging groups selected from the group consisting of: (a) hetero atoms selected from the group consisting of N, O, S, and P, (b) functional groups with at least one of said hetero atoms, (c) saturated or unsaturated hydrocarbons, (d) substituted hydrocarbons, (e) a single atom bridge, and (f) a direct sigma bond between said rotor and each stator; and

Q is a connecting unit between two phenyl rings and is selected from the group consisting of: (a) S, (b) O, (c) NH, (d) NR, (e) hydrocarbon, and (f) substituted hydrocarbon, and

where the vertical thick lines represent said solid substrate to which said molecule is electrically attached.

17. (original) The molecular system of Claim 16 comprising:



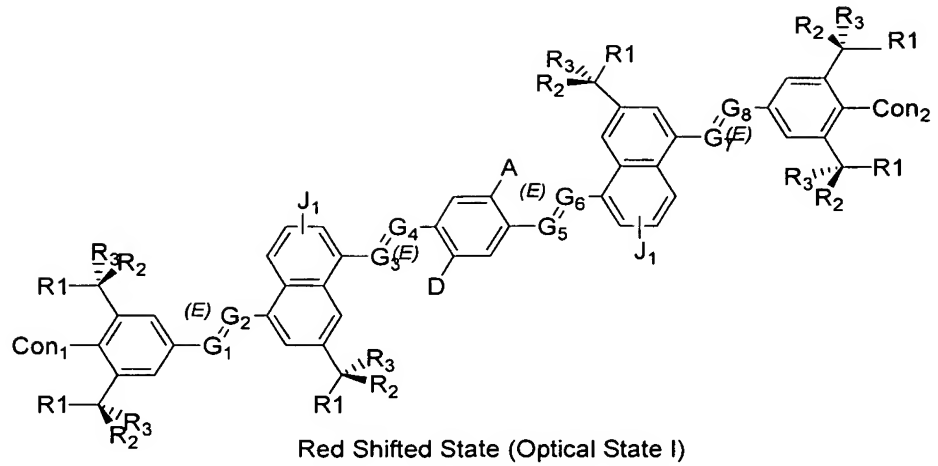
where:

$R_1$ and $R_2$ are independently hydrogen, hydrocarbon or substituted hydrocarbon; and

Y is selected from the group consisting of hydrogen, OH, SH, hydrocarbon or substituted hydrocarbon.

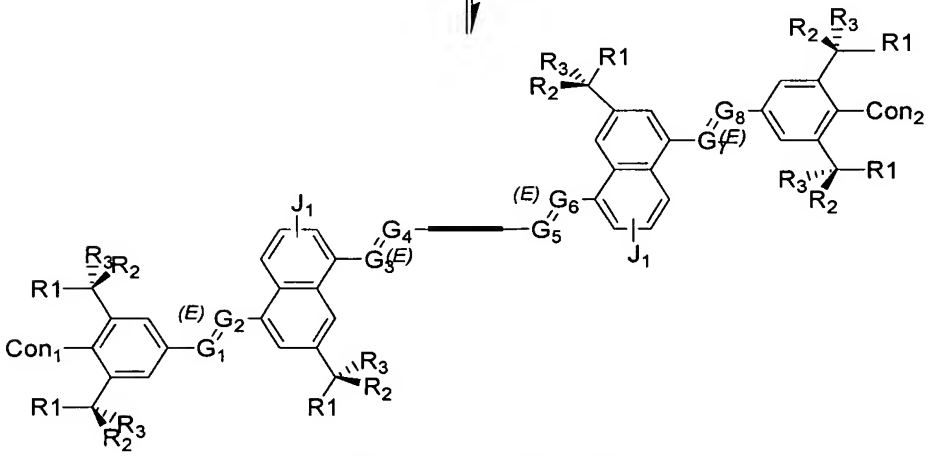
18. (original) The molecular system of Claim 14 wherein said molecular system has an orientation axis and wherein said rotor portion is oriented parallel to said orientation axis, with said external electric field applied perpendicular to said orientation axis.

19. (original) The molecular system of Claim 18 comprising:



Red Shifted State (Optical State I)

Red Shifted ⇌ Blu Shifted



Blu Shifted State (Optical State II)

where:

A is an Acceptor group comprising an electron-withdrawing group selected from the group consisting of: (a) hydrogen, (b) carboxylic acid and its derivatives, (c) sulfuric acid and its derivatives, (d) phosphoric acid and its derivatives, (e) nitro, (f) nitrile, (g) hetero atoms selected from the group consisting of N, O, S, P, F, Cl, and Br, (h) functional groups with at least one of said hetero atoms, (i) saturated or unsaturated hydrocarbons, and (j) substituted hydrocarbons;

D is a Donor group comprising an electron-donating group selected from the group consisting of: (a) hydrogen, (b) amines, (c) OH, (d) SH, (e) ethers, (f) saturated and unsaturated hydrocarbons, (g) substituted hydrocarbons, and (i) functional groups with at least one of hetero atom selected from the group consisting of B, Si, N, O, S, P, and I, wherein said Donor group is relatively more electropositive than said Acceptor group;

$Con_1$ and $Con_2$ are connecting units between one molecule and another molecule or between a molecule and a solid substrate selected from the group consisting of a metal electrode, an inorganic substrate, and an organic substrate, said connecting units independently selected from the group consisting of: (a) hydrogen (utilizing a hydrogen bond), (b) multivalent hetero atoms selected from the group consisting of C, N, O, S, and P, (c) functional groups containing said hetero atoms, (d) saturated or unsaturated hydrocarbons, and (e) substituted hydrocarbons;

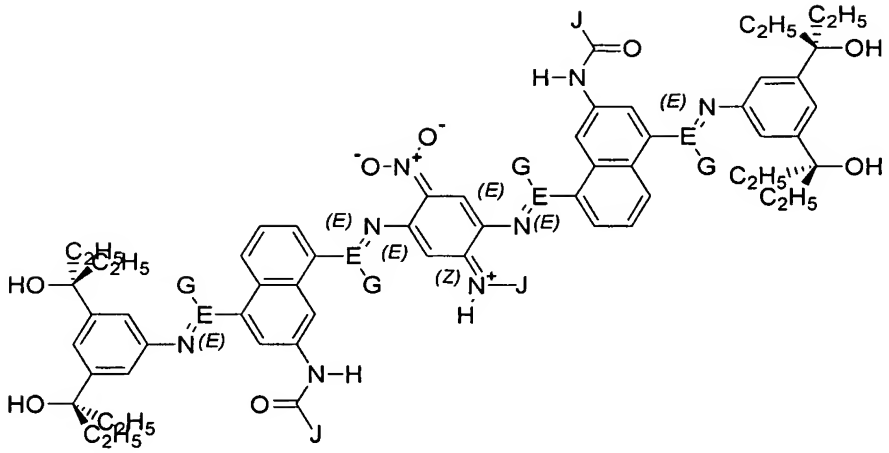
$R_1$, $R_2$ and $R_3$ are spacing groups for providing an appropriate 3-dimensional scaffolding to allow molecules to pack together while providing rotational space for each rotor, said spacing groups selected from the group consisting of: (a) hydrogen, (b) saturated or unsaturated hydrocarbon, and (c) substituted hydrocarbon;

$G_1$, $G_2$, $G_3$, $G_4$, $G_5$, $G_6$, $G_7$, and $G_8$ are bridging groups for connecting said stator to each rotor or to connect two or more conjugated rings to achieve a desired electronic property, said bridging groups selected from the group consisting of: (a) hetero atoms selected from the group consisting of N, O, S, and P, (b) functional groups with at least one of said hetero atoms, (c) saturated or unsaturated hydrocarbons, (d) substituted hydrocarbons, (e) a single atom bridge, and (f) a direct sigma bond between said rotor and each stator; and

$J_1$ and $J_2$ are tuning groups to provide at least one appropriate functional effect selected from the group consisting of inductive effects, resonance effects, and

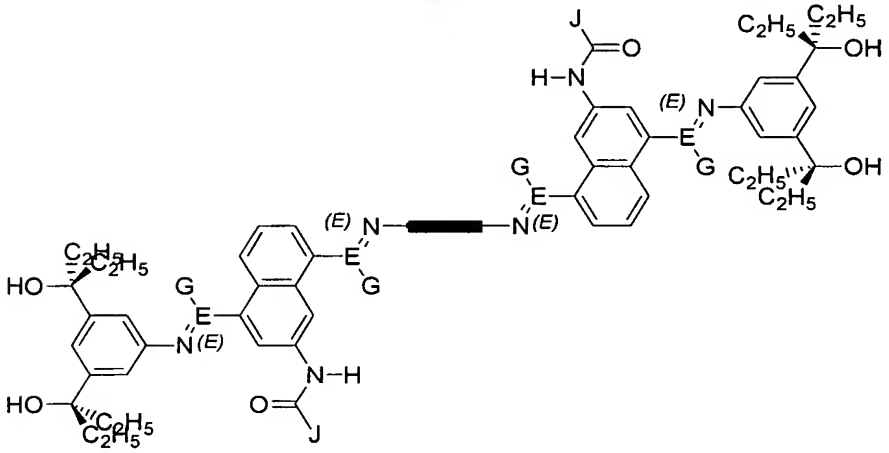
steric effects, said tuning groups being selected from the group consisting of: (a) hydrogen, (b) hetero atoms selected from the group consisting of N, O, S, P, B, F, Cl, Br and I, (c) functional groups with at least one of said hetero atoms, (d) saturated or unsaturated hydrocarbons, and (e) substituted hydrocarbons;

20. (original) The molecular system of Claim 19 comprising:



Red Shifted State (Optical State I)

Red Shifted ⇌ Blu Shifted



Blu Shifted State (Optical State II)

wherein the letters E, G, and J indicate sites where different chemical units can be utilized to adjust geometrical structure and optical properties of said molecular system and have generic designations as follows: E, G, and J are independently selected from the group consisting of hydrogen, heteroatoms, hydrocarbons (either saturated or unsaturated), and substituted hydrocarbons.